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(54) Feeding Filamentary Material

(57) A strapping machine for wrapping filamentary material around a package includes co-operating rotary members for feeding, or back-feeding, the filamentary material and means associated with one of the rotary members for generating electric pulses indicative of rotation of the member. When the roller associated with the pulse generator is brought to rest, by tightening of the material, a discriminator circuit gives a signal for the next operation in a machine cycle to commence.

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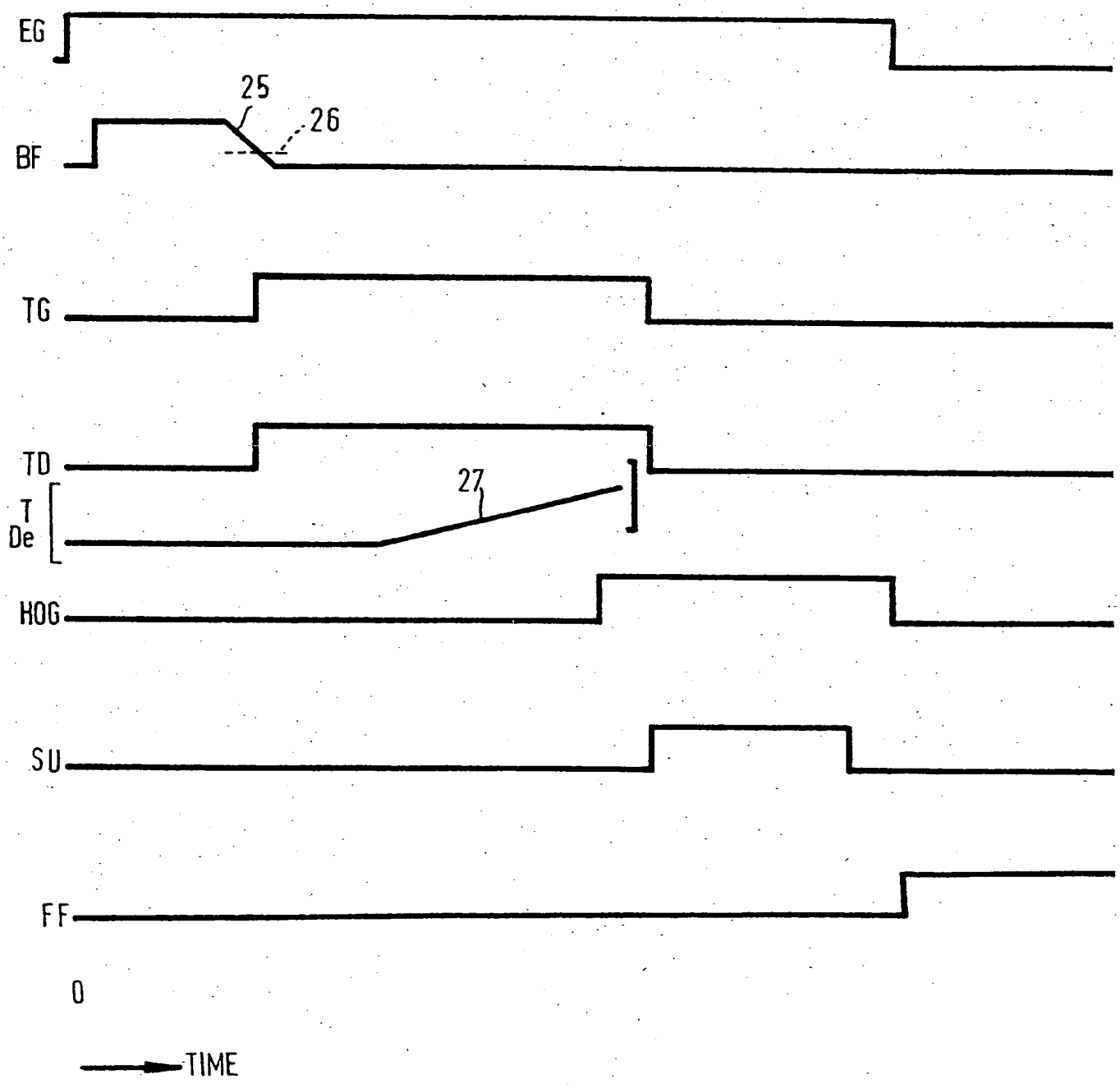
FIG.7



In a third arrangement, the rotary member drives a toothed disc which varies the inductance of the gap in an electro-magnetic circuit to which a DC voltage is applied, this inductance variation producing the required pulses.

A fourth arrangement is similar to the third arrangement except that a high frequency AC voltage, for example having a frequency of between 20—50 KHz is applied to the electro-magnetic circuit and the rotation of the toothed disc provides a series of groups of pulses instead of a series of single pulses.

In a fifth arrangement, the rotary member drives a slotted or apertured disc interposed between the plates of a capacitor and which varies the capacitance thereof. A high frequency AC voltage is applied to the capacitor and again one obtains a series of groups or pulses.

In any of the above arrangements, conventional circuits will be used to slug the pulses of groups thereof to obtain a reasonably continuous signal and a disciminator circuit will be set at a predetermined level to detect the absence of the pulses or the series thereof.

The invention will now be described in detail by way of example with reference to the accompanying diagrammatic drawings in which:—

Figure 1 is a diagram illustrating the arrangement of feed rollers and backfeed rollers in a strapping machine embodying the invention;

Figures 2 to 5 are diagrams illustrating various means for producing pulses;

Figure 6 is a diagram of the various feed rollers and grippers in a strapping machine embodying the invention;

Figure 7 is a chart showing the sequence of operation of the machine.

Referring first to Figures 1 and 6, the strapping machine comprises a frame 10 within which is located a package 11 to be strapped. A filament 12, which may be metal wire or plastics strapping will, at the end of a previous cycle, have been fed around the frame 10 by forward feed rollers FF until the free end 13 of the filament is detected whereupon the forward feed rollers FF will be disabled. These rollers are shown in Figure 1 at 14 and 15. The roller 15 is driven, by means not shown, and the roller 14 is mounted on an arm 16, pivoted at 17 and movable about the pivot by a solenoid 18. When the rollers 14 and 15 are brought together by the solenoid 18 they grip the filament 12 but when they are moved apart the filament can pass freely between the rollers.

At the end of a preceding cycle, the filament will have been fed as described and if a new cycle is now initiated, the first thing that will happen is that an end gripper EG will grip the free end 13 of the filament. This is indicated by the rise of the line EG in Figure 7 from its datum level at time 0. It will be seen from Figure 7 that at time 0 all the other items of the machine which will be referred to and described below are at their datum levels and are therefore inoperative. Means, not shown, will sense that the end gripper is operative, these means may, for example, be a switch operated by the end gripper. This passes a signal to activate the back-feed rolls BF shown in Figure 1 and comprising a driven roller, a freely rotatable roller 20, an arm 21 on which the roller 20 is mounted, the arm 21 being pivoted at 22, and a solenoid 23 to operate the arm 21 to bring the back-feed rollers into operative relation to grip the filament 12 or to move them to inoperative relation as described for the forward feed rollers FF. The back-feed rollers are operated by driving the roller 19 with the rollers 19 and 20 in their operative relation and the freely rotatable roller 20 is arranged, as will be described below, to produce a series of electrical pulses or groups of pulses. The result of back-feeding will be to tighten the filament 12 around the package 11, back-feeding moving the filament in the direction of the arrow 24 in Figure 6. The back-feeding will continue until the filament is engaged with the package 11. The rollers 19 and 20 will be incapable of tightening the filament further and the roller 19, although it will continue to rotate, will skid on the filament while the roller 20 will come to rest. The coming of the roller 20 to rest will be detected by a discriminator circuit which has been sensing the pulses. The pulses, or groups thereof, will have been slugged to produce a generally constant signal which will decay as indicated at 25 in Figure 7. At a predetermined point in the decaying signal, indicated by the dotted line 26, the discriminator circuit will give a signal for the next operation to commence.

The next operation is for the tension gripper TG to come on to grip the filament as indicated by the line TG in Figure 7 when the discriminator circuit senses the decay in the signal. The tension gripper having gripped the filament at the position shown in Figure 6, the tension device TD then comes on as indicated by that line in Figure 7 and, as indicated in Figure 6, the filament is tensioned about the package as indicated at 27. The tension in the filament is sensed by a tension-detector (not shown) and the increase in signal in this detector is indicated by the inclined line 27 labelled T Det in Figure 7. When the tension reached a predetermined value, the hold-on gripper HOG comes on as indicated by that line in Figure 7 and grips the filament. The end gripper and the hold-on gripper may be aligned. The sealing unit SU is then operated to unite the overlying parts of the filament indicated at 28 and 29. If the filament is plastics strapping then the sealing unit will weld the overlapping parts 28 and 29 by heat-swelling them or by friction welding. If the filament is a wire then the sealing unit will twist the overlapping parts together.

It will be noted from Figure 7 that when the hold-on gripper has come on, the tension gripper TG and the tensioning device come off. The sealing unit is operated for sufficiently long to provide the seal and then hold-on gripper and end gripper come off as shown in Figure 7. At some state the filament forming the loop is severed from the filament in the supply S. This may be

the cell being variable dependant on the light allowed to fall on it and thus producing pulses when connected in an electric circuit.

8. A machine as claimed in any one of claims 1 to 5 wherein the rotary member drives a toothed disc for varying the inductance of the gap in an electro-magnetic circuit to which a DC voltage is applied, the inductance variation producing the pulses or groups of pulses.

9. A machine as claimed in any of claims 1 to 5 wherein the rotary member drives a toothed disc which varies the inductance of the gap in an electro-magnetic circuit to which an AC voltage is applied, the inductance variation producing a series of groups of pulses.

10. A machine as claimed in any one of claims of 1 to 5 wherein the rotary member drives a slotted or apertured disc interposed between the plates of a capacitor and which varies the capacitance thereof, an AC voltage being applied to the capacitor to generate a series of groups of pulses.

11. A strapping machine for wrapping filamentary material around a package constructed and arranged substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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